Benefit-Cost Analysis of DERs - An Overview of the New National Standard Practice Manual

August 27, 2020

Hosted by Lawrence Berkeley National Laboratory

Agenda

1. Introduction and Background
   - Julie Michals, E4TheFuture

2. NSPM BCA Framework (Parts I-II)
   - Tim Woolf, Synapse Energy Economics

3. DER BCA Guidance (Parts III-IV)
   - Mike Alter, ICF
   - Tim Woolf, Synapse Energy Economics

4. Next steps
   - Julie Michals, E4TheFuture
   - Andy Satchwell, Lawrence Berkeley National Lab
   - Jeff Loiter, National Regulatory Research Institute

5. Q&A

Plus various 30-sec polls throughout webinar….

First, some logistics:

Audience is muted. Please enter your questions in the Q&A box.

This presentation and recording will be sent to all registrants after the webinar and made available at https://emp.lbl.gov/webinars

Please tell us a bit about yourself, and your familiarity with the NSPM…

Poll #1 and #2

Why an NSPM for DERs?

Traditional cost-effectiveness tests often do not address pertinent state policies.

Traditional tests are often modified by states in an ad-hoc manner, without clear principles or guidelines.

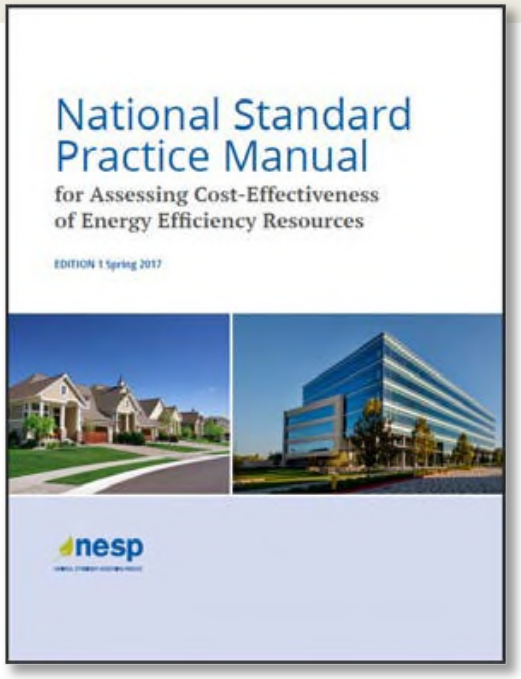
DERs are treated inconsistently in many BCAs.

DERs are often not accurately valued

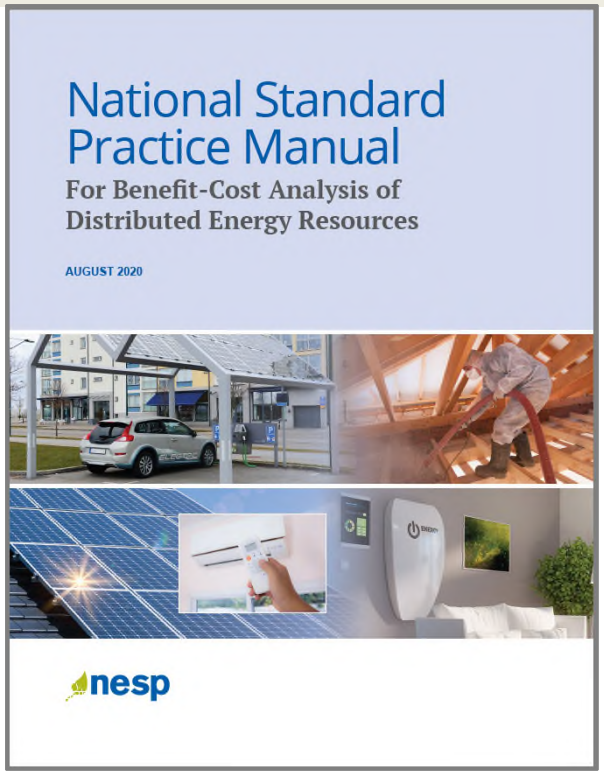
There is a lack of transparency on why tests are chosen and how they are applied.

The National Energy Screening Project (NESP) is a stakeholder organization and is open to all organizations and individuals with an interest in working collaboratively to improve cost-effectiveness screening practices.

NSPM for EE
May 2017



NSPM for DERs
August 2020

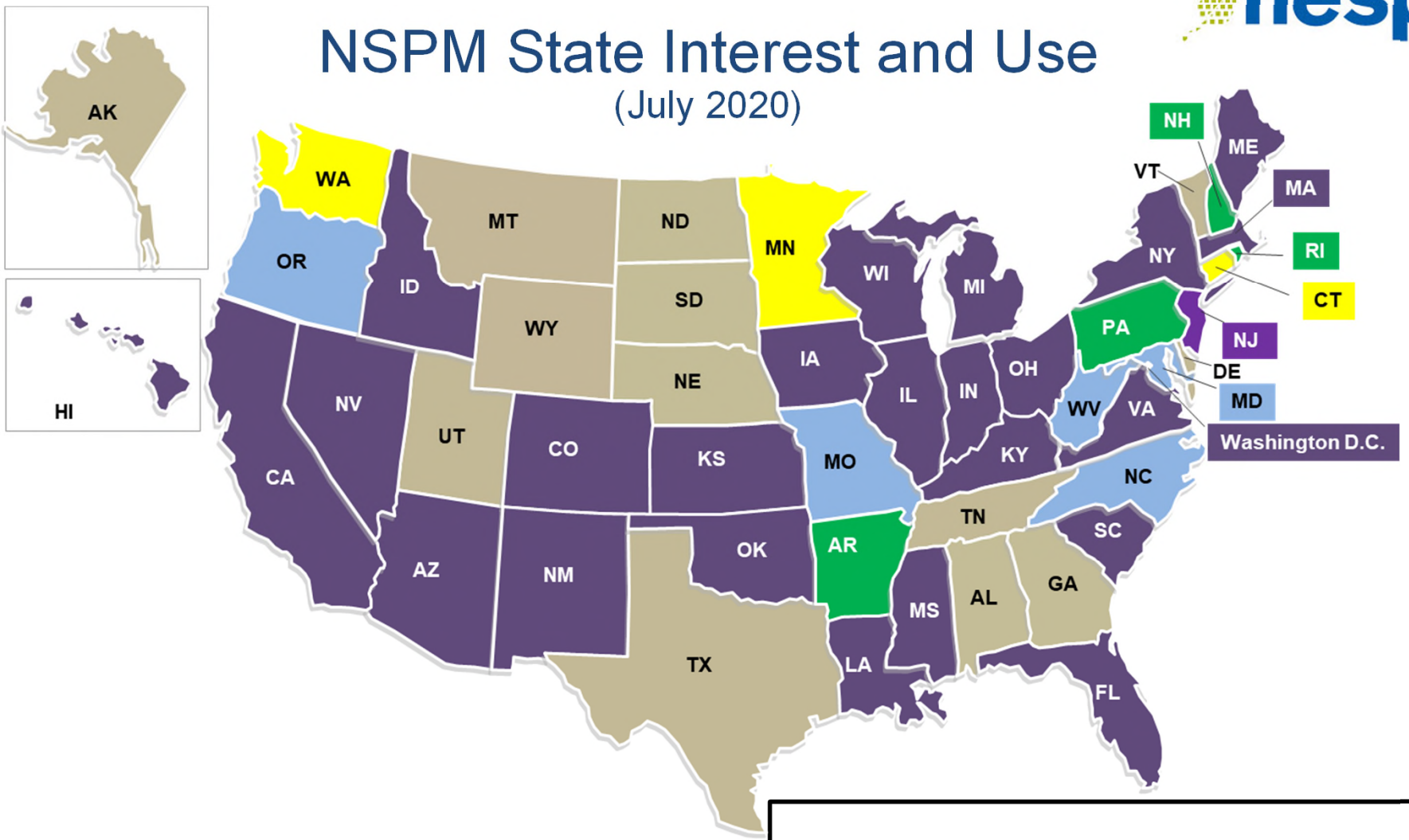


The 2020 NSPM for DERs incorporates and expands on the 2017 NSPM for EE

https://nationalenergyscreeningproject.org/national-standard-practice-manual/

NSPM State Interest and Use

(July 2020)



States Referencing/Applying the NSPM

4	PUC Order (final/tentative) on use of NSPM
3	Actively applying NSPM to review current test
5	In process of learning about the NSPM
25	References made in PUC/legislative proceedings

NSPM for DERs - Development

- Managed and funded by E4TheFuture (with support from US DOE via LBNL)
- Multiple co-authors
  - Extensive understanding of regulatory economics
  - Specialized expertise with different DERs
- Advisory Group
  - 45+ individuals
  - Diversity of perspectives
  - Input on Manual outline and drafts

NSPM for DERs - Project Team

Project Management

- Julie Michals, E4TheFuture (Project Manager)

Report Authors

- Tim Woolf, Synapse Energy Economics (Lead Author)
- Chris Neme, Energy Futures Group
- Mike Alter, ICF
- Steve Fine, ICF
- Karl Rábago, Pace Energy and Climate Center
- Steve Schiller, Schiller Consulting
- Kate Strickland, Smart Electric Power Alliance
- Brenda Chew, Smart Electric Power Alliance

NSPM for DERs - Advisory Group

Name	Affiliation	Name	Affiliation
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Elizabeth Titus	Northeast Energy Efficiency Partnerships	Ric O'Connell	Grid Lab
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Gregory Ehrendreich	Midwest Energy Efficiency Alliance	Rachel Gold	American Council for Energy Eff Econ
Greg Wikler	CA Efficiency Demand Mgmt Council	Rodney Sobin	Nat'l Assoc of State Energy Officials
Jack Laverty	Columbia Gas of Ohio	Ryan Katofsky	Advanced Energy Economy
Janet Gail Besser	Smart Electric Power Alliance	Sami Khawaja	Cadmus
Jennifer Morris	Illinois Commerce Commission	Steven Rymsha	Sunrun
Joe Cullen	Building Performance Assoc	Todd Bianco	RI Public Utilities Commission
Johanna Zetterberg	US DOE - EERE	Tom Stanton	Nat'l Regulatory Research Institute
John Agan	US DOE - Wx/Intergovt Programs	Wally Nixon	Arkansas Public Service Commission
John Shenot	Regulatory Assistance Project		

NSPM for DERs – Audience and Uses

Audience: All entities overseeing/guiding DER decision (PUCs, SEOs, utilities, DER reps, evaluators, consumer advocates, and others)

Purpose: Guidance for valuing DER opportunities to inform policies and strategies that support state goals/objectives, such as:

- Expanding EE/DR plans, strategies, and programs to broader set of DERs.
- Evaluating and planning for non-wires/pipes solutions.
- Incorporating DERs into distribution system planning.
- Achieving electrification goals, including EV goals.
- Achieving environmental and carbon emission objectives.

Applies to:

- **Programs**: initiatives and policies implemented by utilities or other entities to encourage adoption of DERs.
- **Procurements:** initiatives to procure DERs, whether built by a utility or procured from third-party vendors e.g., competitive procurement
- **Pricing Mechanisms**: such as those designed to compensate DERs for their value to grid or to achieve other policy objectives (e.g., time-of-use rates, peak time rebates, critical peak pricing)

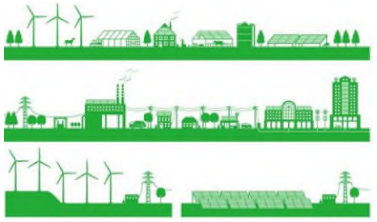
General Scope
BCA Framework

Presents a comprehensive **BCA Framework** with 3 components:

General Scope (2)
Three Tiers of DER Analyses

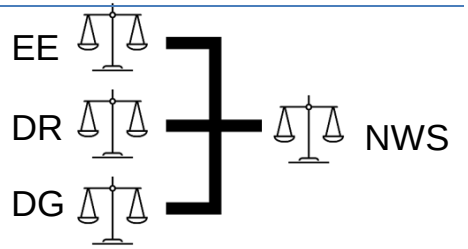
Level Three: Multiple DERs + Utility System

- Allows all resources, both utility-scale and distributed, to be optimized for stated purpose of analysis (e.g., least-cost system)



Level Two: Multiple DERs

- Allows for multiple DERs to be optimized for state purpose of analysis (e.g., least-cost system) where utility system is static (i.e., fixed input)



Level One: Single DER

- Allows for single DER analysis using the utility system as a fixed input

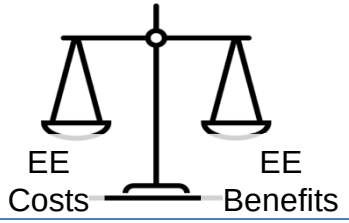


Image Source: LBNL (2018). A Framework for Integrated Analysis of Distributed Energy Resources: Guide for States.

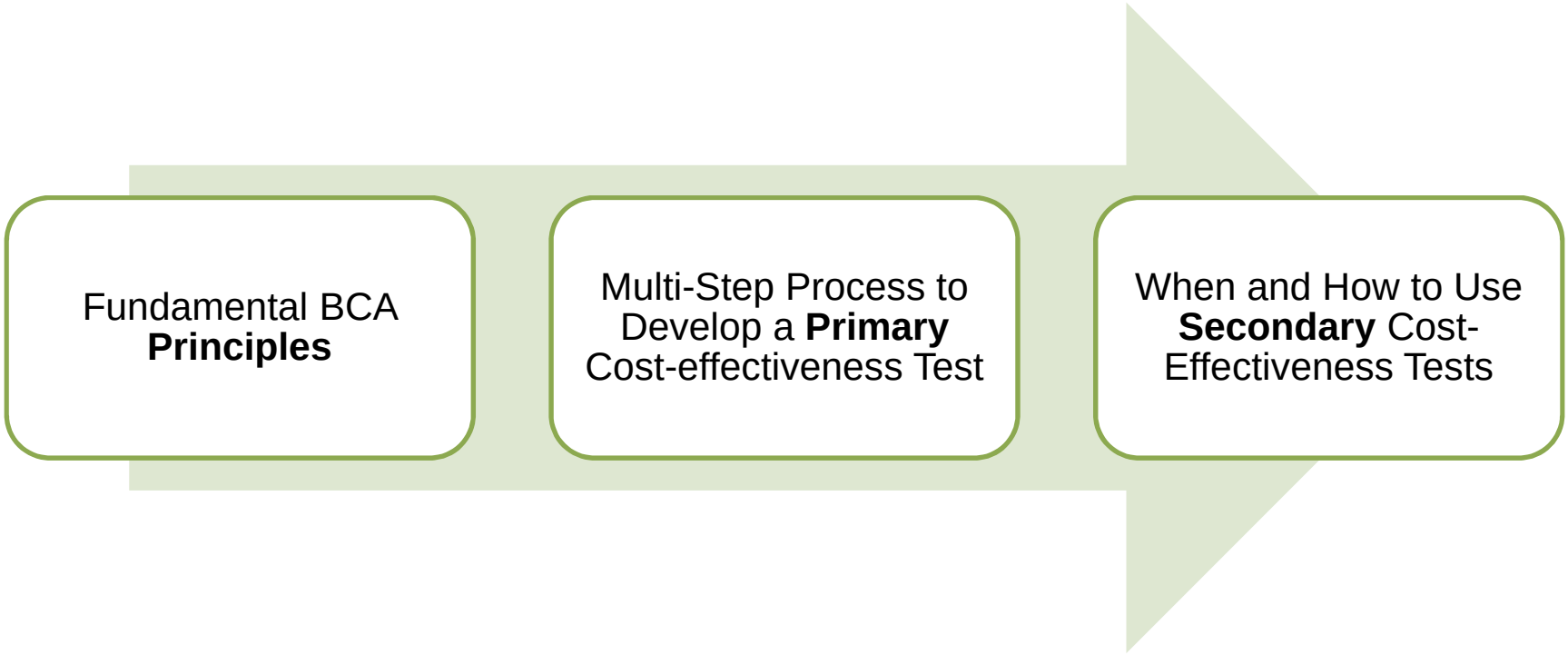
NSPM for DERs - TOC

NSPM for DERs – PART I

The NSPM Benefit-Cost Analysis Framework

Poll #3

NSPM BCA Framework



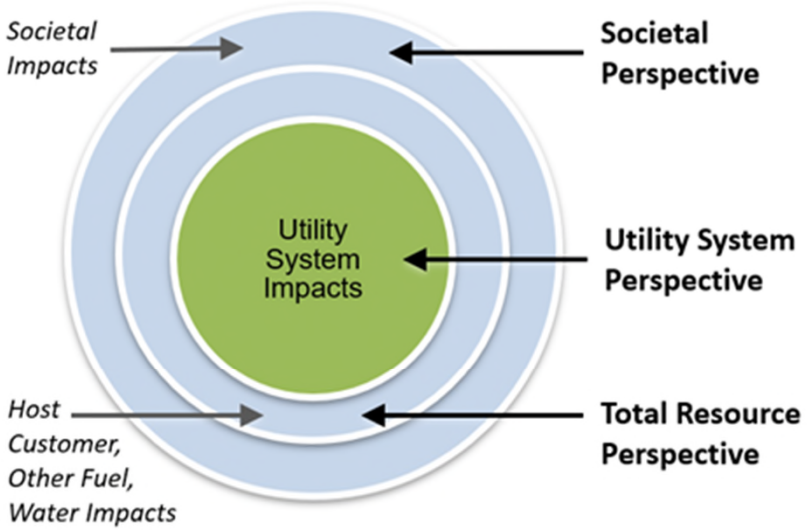
Ch 2. NSPM BCA Principles

1. Recognize that EE and other DERs can provide energy or power system needs, and therefore should be compared with other energy resources and treated consistently for benefit-cost analyses.
2. Align primary test with applicable policy goals.
3. Ensure symmetry across costs and benefits
4. Account for all relevant, material impacts (based on applicable policies), even if hard to quantify.
5. Conduct a forward-looking, long-term analysis that captures incremental impacts of the DER investment.
6. Avoid double-counting through clearly defined impacts.
7. Ensure transparency in presenting the analysis and the results.
8. Conduct BCA separate from Rate Impact Analyses because they answer different questions.

Cost-Effectiveness Perspectives

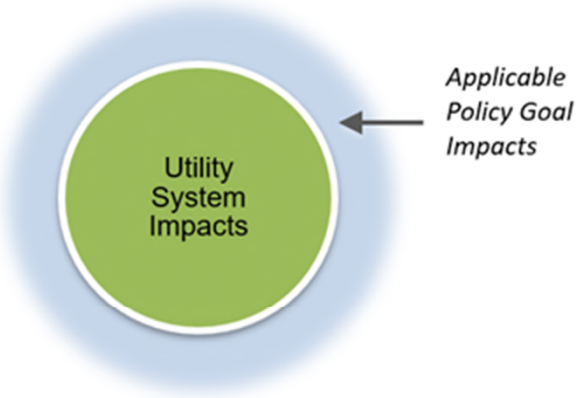
NSPM for DERs

Traditional Perspectives



- Three perspectives define the scope of impacts to include in the most common traditional cost-effectiveness tests.

Regulatory Perspective



- Perspective of public utility commissions, legislators, muni/coop boards, public power authorities, and other relevant decision-makers.
- Accounts for utility system plus impacts relevant to a jurisdiction's applicable policy goals (which may or may not include host customer impacts).
- Can align with one of the traditional test perspectives, but not necessarily.

Ch 3. Defining Primary Cost-Effectiveness Test

STEP 1 **Articulate Applicable Policy Goals**

Articulate the jurisdiction's applicable policy goals related to DERs.

STEP 2 **Include All Utility System Impacts**

Identify and include the full range of utility system impacts in the primary test, and all BCA tests.

STEP 3 **Decide Which Non-Utility System Impacts to Include**

Identify those non-utility system impacts to include in the primary test based on applicable policy goals identified in Step 1:

- Determine whether to include host customer impacts, low-income impacts, other fuel and water impacts, and/or societal impacts.

STEP 4 **Ensure that Benefits and Costs are Properly Addressed**

Ensure that the impacts identified in Steps 2 and 3 are properly addressed, where:

- Benefits and costs are treated symmetrically;
- Relevant and material impacts are included, even if hard to quantify;
- Benefits and costs are not double-counted; and
- Benefits and costs are treated consistently across DER types

STEP 5 **Establish Comprehensive, Transparent Documentation**

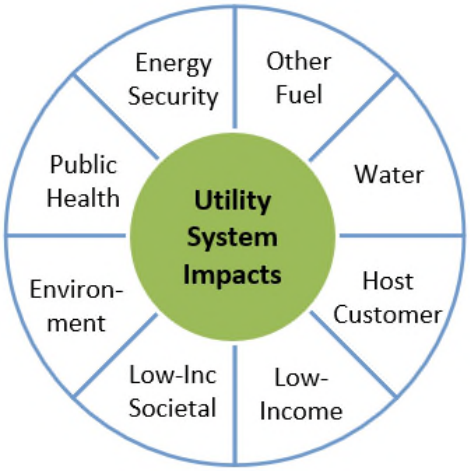
Establish comprehensive, transparent documentation and reporting, whereby:

- The process used to determine the primary test is fully documented; and
- Reporting requirements and/or use of templates for presenting assumptions and results are developed.

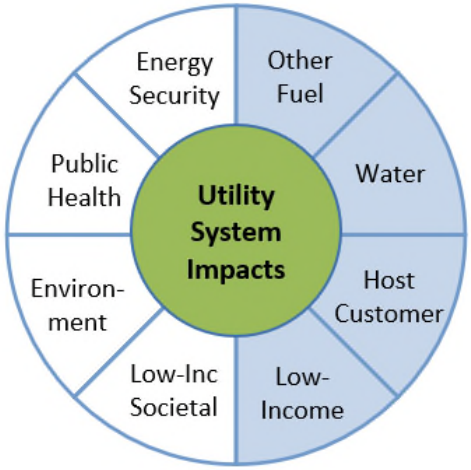
The Jurisdiction Specific Test (JST)

Hypothetical JSTs as compared to traditional tests

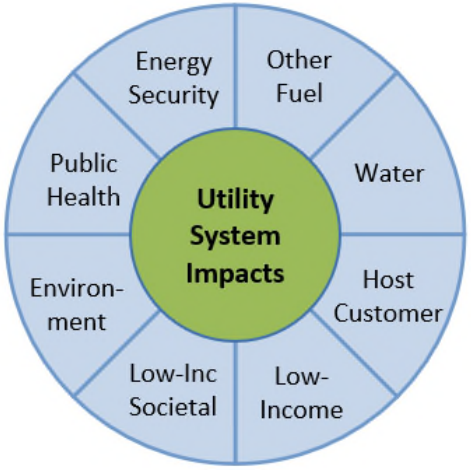
JST 1 = UCT/PAC Test



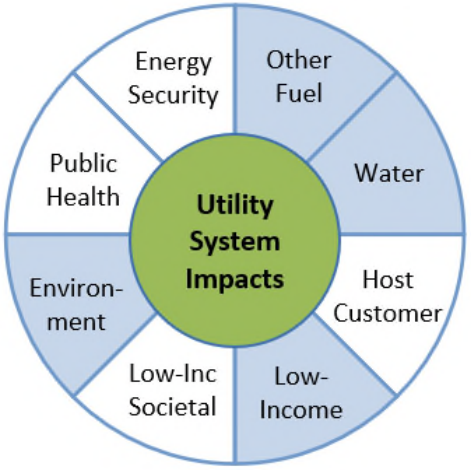
JST 2 = TRC Test



JST 3 = SCT



JST 4 ≠ traditional CE test *



Full range of utility system impacts included

Non-utility system impacts included

Non-utility system impacts not included

*JST 4 and other example JSTs 5, 6, 7 etc. could include a different set of non-utility system impacts *depending on the applicable policies* of those jurisdictions. JSTs may or may not include host customer (participant) impacts and may or may not align with traditional tests.

Use of Secondary Tests

NSPM provides guidance on **when and how to use secondary tests.**

While a jurisdiction's primary test informs whether to fund or otherwise support DERs, secondary tests can help to:

- inform decisions on how to prioritize DERs;
- inform decisions regarding marginally non- and/or cost-effective DERs; and
- encourage consistency across DER types.

NSPM for DERs – PART II

DER Benefits & Costs and Cross-Cutting Issues

Ch 4. DER Benefits & Costs

Electric Utility System Impacts

Type	Utility System Impact	Description
Generation	Energy Generation	The production or procurement of energy (kWh) from generation resources on behalf of customers
	Capacity	The generation capacity (kW) required to meet the forecasted system peak load
	Environmental Compliance	Actions to comply with environmental regulations
	RPS/CES Compliance	Actions to comply with renewable portfolio standards or clean energy standards
	Market Price Effects	The decrease (or increase) in wholesale market prices as a result of reduced (or increased) customer consumption
	Ancillary Services	Services required to maintain electric grid stability and power quality
Transmission	Transmission Capacity	Maintaining the availability of the transmission system to transport electricity safely and reliably
	Transmission System Losses	Electricity or gas lost through the transmission system
Distribution	Distribution Capacity	Maintaining the availability of the distribution system to transport electricity or gas safely and reliably
	Distribution System Losses	Electricity lost through the distribution system
	Distribution O&M	Operating and maintaining the distribution system
	Distribution Voltage	Maintaining voltage levels within an acceptable range to ensure that both real and reactive power production are matched with demand
General	Financial Incentives	Utility financial support provided to DER host customers or other market actors to encourage DER implementation
	Program Administration	Utility outreach to trade allies, technical training, marketing, and administration and management of DERs
	Utility Performance Incentives	Incentives offered to utilities to encourage successful, effective implementation of DER programs
	Credit and Collection	Bad debt, disconnections, reconnections
	Risk	Uncertainty including operational, technology, cybersecurity, financial, legal, reputational, and regulatory risks
	Reliability	Maintaining generation, transmission, and distribution system to withstand instability, uncontrolled events, cascading failures, or unanticipated loss of system components
	Resilience	The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions

Ch 4. DER Benefits & Costs

Gas Utility or Other Fuel Impacts

Type	Gas Utility or Other Fuel Impact	Description
Energy	Fuel and Variable O&M	The fuel and O&M impacts associated with gas or other fuels.
	Capacity	The gas capacity required to meet forecasted peak load.
	Environmental Compliance	Actions required to comply with environmental regulations.
	Market Price Effects	The decrease (or increase) in wholesale prices as a result of reduced (or increased) customer consumption.
General	Financial Incentives	Utility financial support provided to DER host customers or other market actors to encourage DER implementation.
	Program Administration Costs	Utility outreach to trade allies, technical training, marketing, and administration and management of DERs.
	Utility Performance Incentives	Incentives offered to utilities to encourage successful, effective implementation of DER programs.
	Credit and Collection Costs	Bad debt, disconnections, reconnections.
	Risk	Uncertainty including operational, technology, cybersecurity, financial, legal, reputational, and regulatory risks.
	Reliability	Maintaining the gas or other fuel system to withstand instability, uncontrolled events, cascading failures, or unanticipated loss of system components.
	Resilience	The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.

Ch 4. DER Benefits & Costs

Host Customer Impacts

Type	Host Customer Impact	Description
Host Customer	Host portion of DER costs	Costs incurred to install and operate DERs
	Host transaction costs	Other costs incurred to install and operate DERs
	Interconnection fees	Costs paid by host customer to interconnect DERs to the electricity grid
	Risk	Uncertainty including price volatility, power quality, outages, and operational risk related to failure of installed DER equipment and user error; this type of risk may depend on the type of DER
	Reliability	The ability to prevent or reduce the duration of host customer outages
	Resilience	The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions
	Tax incentives	Federal, state, and local tax incentives provided to host customers to defray the costs of some DERs
	Host Customer NEIs	Benefits and costs of DERs that are separate from energy-related impacts
	Low-income NEIs	Non-energy benefits and costs that affect low-income DER host customers

Host Customer NEI	Summary Description
Transaction costs	Costs incurred to adopt DERs, beyond those related to the technology or service itself (e.g., application fees, time spent researching, paperwork)
Asset value	Changes in the value of a home or business as a result of the DER (e.g., increased building value, improved equipment value, extended equipment life)
Productivity	Changes in a customer's productivity (e.g., changes in labor costs, operational flexibility, O&M costs, reduced waste streams, reduced spoilage)
Economic well-being	Economic impacts beyond bill savings (e.g., reduced complaints about bills, reduced terminations and reconnections, reduced foreclosures—especially for low-income customers)
Comfort	Changes in comfort level (e.g., thermal, noise, and lighting impacts)
Health & safety	Changes in customer health or safety (e.g., fewer sick days from work or school, reduced medical costs, improved indoor air quality, reduced deaths)
Empowerment & control	The satisfaction of being able to control one's energy consumption and energy bill
Satisfaction & pride	The satisfaction of helping to reduce environmental impacts (e.g., one of the reasons why residential customers install rooftop PV)

Ch 4. DER Benefits & Costs

Societal Impacts

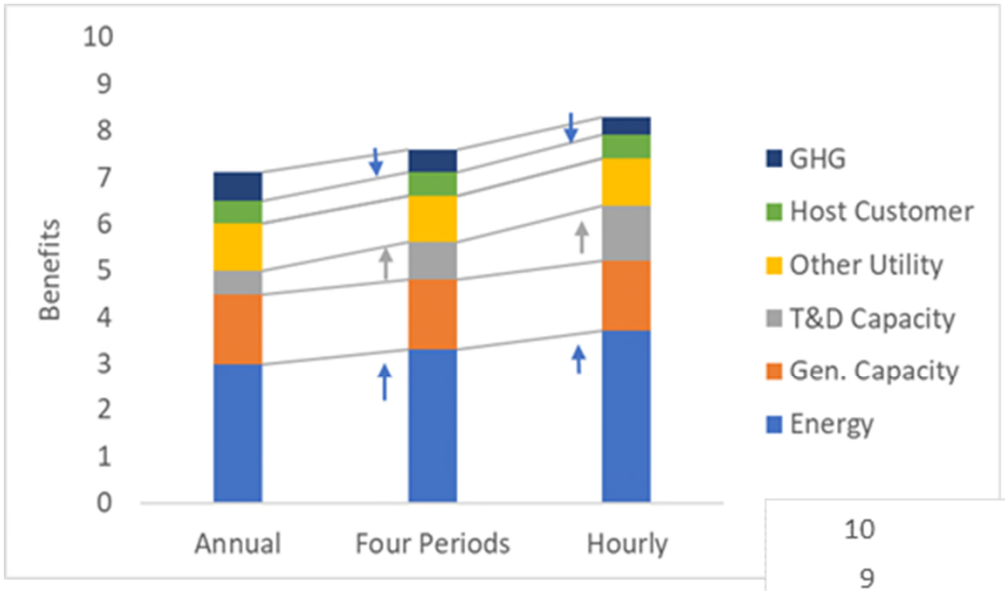
Type	Societal Impact	Description
Societal	Resilience	Resilience impacts beyond those experienced by utilities or host customers
	GHG Emissions	GHG emissions created by fossil-fueled energy resources
	Other Environmental	Other air emissions, solid waste, land, water, and other environmental impacts
	Economic and Jobs	Incremental economic development and job impacts
	Public Health	Health impacts, medical costs, and productivity affected by health
	Low Income: Society	Poverty alleviation, environmental justice, and reduced home foreclosures
	Energy Security	Energy imports and energy independence

Ch 5. Cross-cutting DER Considerations

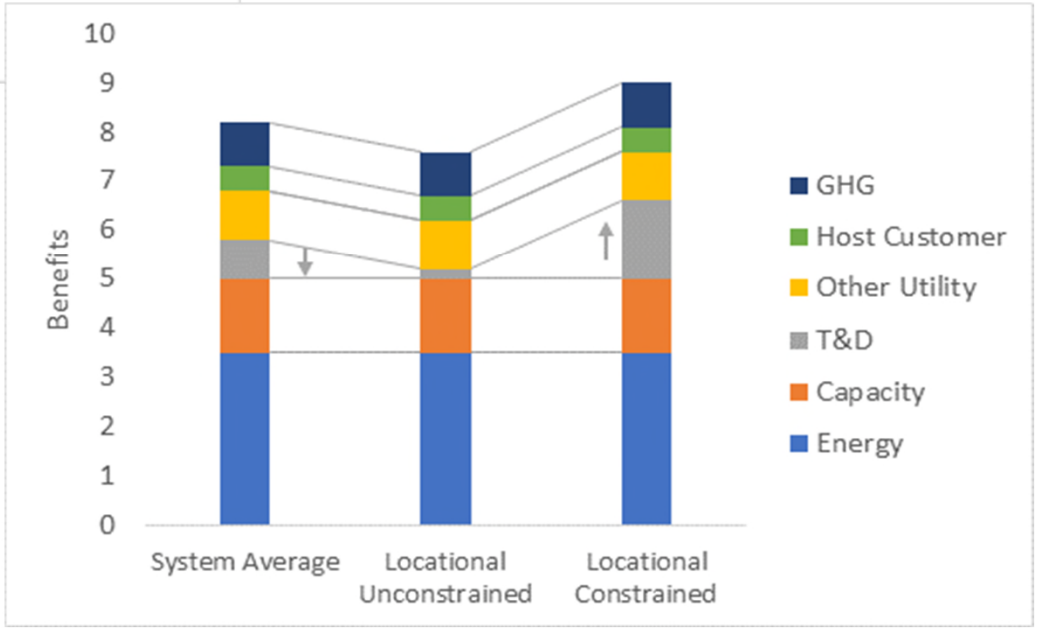
- Temporal Impacts
- Locational Impacts
- Interactive Effects
- Behind-the-Meter Versus Front-of-the-Meter
- Air Emission Impacts
- Transfer Payments and Offsetting Impacts
- Variable Renewable Generation Impacts
- Wholesale Market Revenues
- Free Riders and Spillover Impacts
- Discount Rates

Poll #4

Temporal Impacts on EE Benefits
Hypothetical Example



Location Impacts on DR Benefits
Hypothetical Example



NSPM for DERs – PART III

BCA for Specific DER Technologies

NSPM for DERs
DER-Specific Chapters 6-10

- Energy Efficiency Resources
- Demand Response Resources
- Distributed Generation Resources
- Distributed Storage Resources
- Electrification

Each chapter covers:

- Benefits and costs of the specific resource
- Key factors that affect impacts
- Common challenges in estimating benefits and costs

Poll #5

Example: Chapter 9 - Storage Content

Headings | Pages | Results

- 9. Distributed Storage Resources
  - 9.1 Summary of Key Points
  - 9.2 Introduction
  - 9.3 Benefits and Costs of Distributed Storage Resources
  - 9.4 Key Factors that Affect Distributed Storage Impacts
    - 9.4.1 Technology Characteristics
    - 9.4.2 Technology Operating Profile
    - 9.4.3 Other Fuel Impacts
    - 9.4.4 Host Customer Non-Energy Impacts
    - 9.4.5 Air Emissions Impacts
    - 9.4.6 Interconnection Location and Process
    - 9.4.7 Compensation Mechanisms
    - 9.4.8 Resource Ownership and Control
  - 9.5 Common Challenges for Determining Storage Benefits and Costs
    - 9.5.1 Determining the Operating Profile
    - 9.5.2 Determining the Counterfactual Host Customer Baseline
    - 9.5.3 Accounting for Provision of Multiple Services
  - 9.6 Lost Revenues and Rate Impacts

Table 9-1. Potential Impacts of Distributed Storage: Electric Utility System

Type	Utility System Impact	Benefit or Cost	Notes, or Typical Applicability
Generation	Energy Generation	●	A cost because storage technologies generally require more energy to charge than what they discharge
	Generation Capacity	●	A benefit, depending upon the storage use case and the electric utility's ability to affect the operation of the storage device; otherwise, a cost if storage device charges during peak periods
	Environmental Compliance	●	A benefit or cost depending upon system environmental profile during charging and discharging times
	RPS/CES Compliance	●	A cost because storage technologies generally require more energy to charge than what they discharge
	Market Price Response	●	A benefit or cost depending upon market conditions during charging and discharging times
	Ancillary Services	●	A benefit or cost depending upon the storage use case and the electric utility's ability to affect the operation of the storage device
Transmission	Transmission Capacity	●	Potentially benefits depending upon the storage use case and the electric utility's ability to affect the operation of the storage device; otherwise, potentially costs if storage device charges during transmission peak periods
	Transmission Line Losses	●	
Distribution	Distribution Capacity	●	Potentially benefits depending upon the storage use case and the electric utility's ability to affect the operation of the storage device; otherwise, potentially costs if storage device charges during distribution peak periods
	Distribution Line Losses	●	
	Distribution O&M	●	
	Distribution Voltage	●	
General	Financial Incentives	●	Typically costs to the extent they are relevant
	Program Administration Costs	●	
	Utility Performance Incentives	●	
	Credit and Collection Costs	●	A benefit because customer savings make bill payment easier, especially for low-income customers
	Risk	●	Potentially benefits depending upon the storage use case and the electric utility's ability to affect the operation of the storage technology during peak or emergency periods
	Reliability	●	
	Resilience	●	

● = typically a benefit for this resource type; ● = typically a cost for this resource type; ● = either a benefit or cost for this resource type, depending upon the application of the resource; O = not relevant for this resource type.

Example: Storage Impacts

Benefit or Cost (or 'Depends')

DER Comparison Tables

For Utility System, Host Customer and Societal Impacts

Example: Host Customer Impacts

Table S-7. Potential Benefits and Costs of DERs: DER Host Customer

Type	Host Customer Impact	EE	DR	DG	Storage	Electrification
Host Customer	Host portion of DER costs	●	●	●	●	●
	Interconnection fees	○	○	●	●	○
	Risk	●	○	●	●	●
	Reliability	●	●	●	●	●
	Resilience	●	●	●	●	●
	Tax Incentives	●	●	●	●	●
	Host Customer NEIs	●	●	●	●	●
	Low-income NEIs	●	●	●	●	●

● = typically a benefit for this resource type; ● = typically a cost for this resource type; ● = either a benefit or cost for this resource type, depending upon the application of the resource; ○ = not relevant for this resource type

NSPM for DERs – PART IV

BCA for Multiple DERs

NSPM for DERs
Multi-DER Chapters 11-14

Chapters:

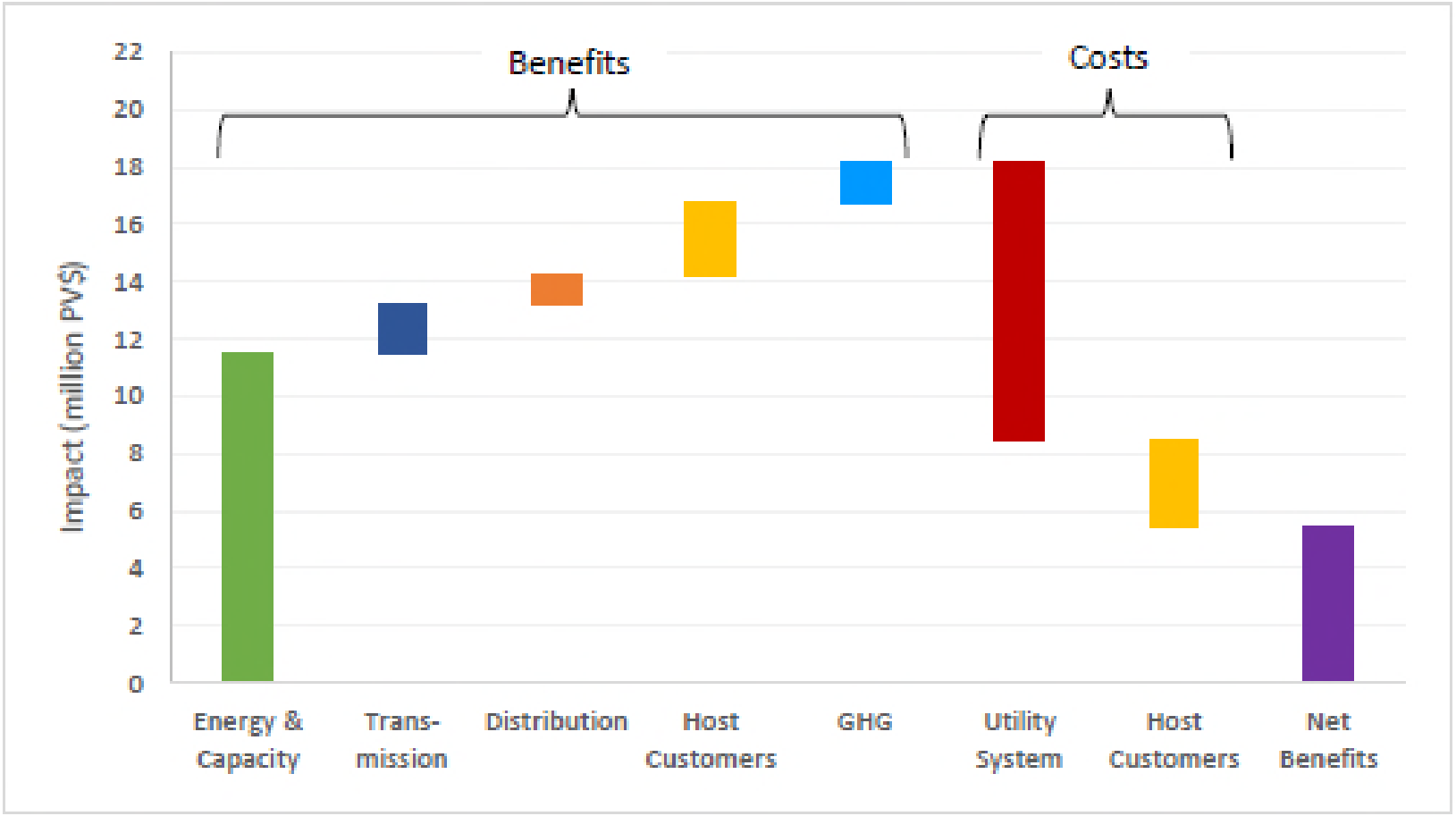
- Multiple on-site DER types - such as grid-integrated efficient buildings (GEBs)
- Non-wires solution (NWS) - Multiple DER types in a specific geographic location
- System-wide DER Portfolios: multiple DER types across a utility service territory
- Dynamic system planning practices that can be used to optimize DERs and alternative resources (IGP, IDP, IRP)

Content in each Chapter:

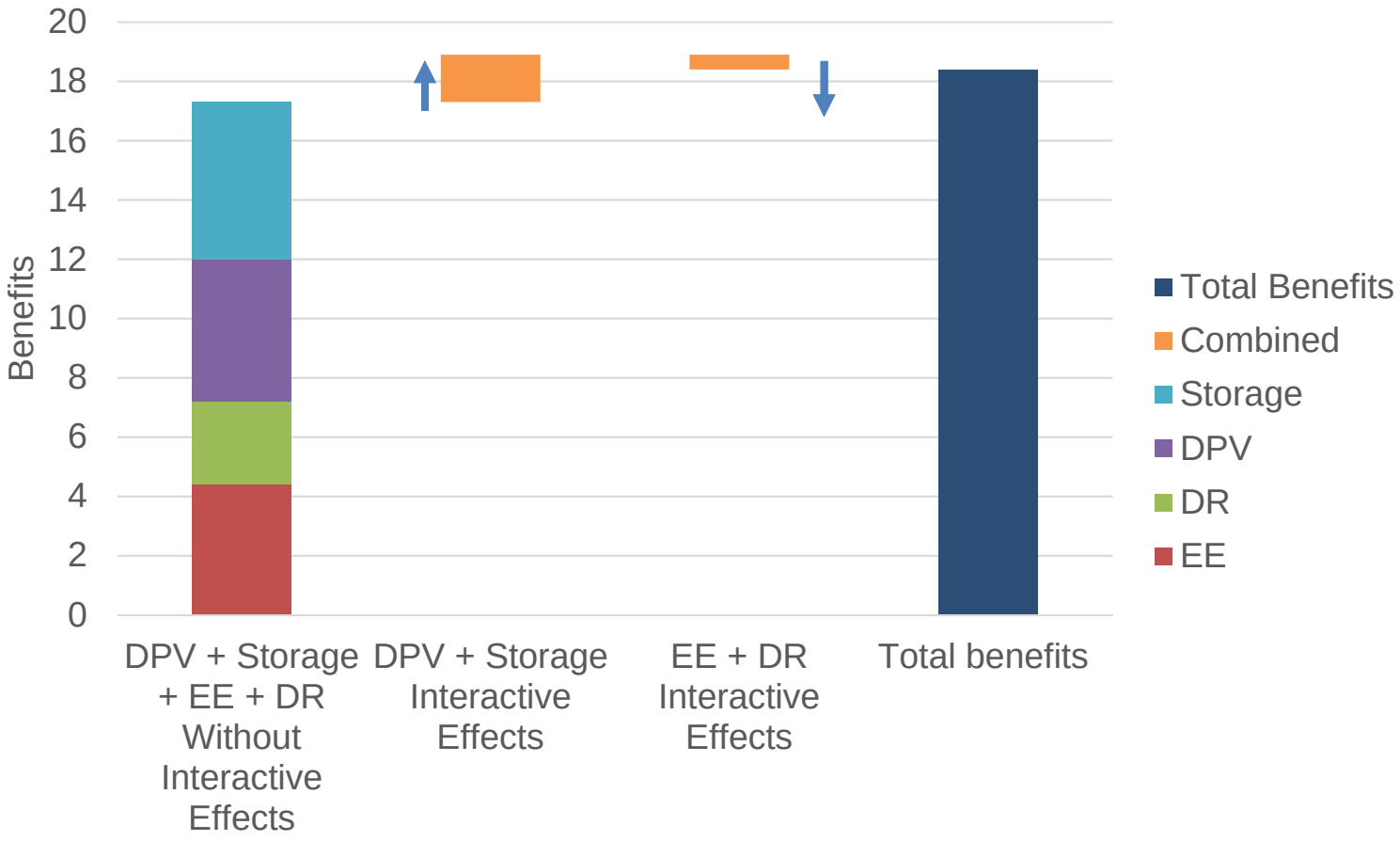
- Summary of key points
- Description of how the multiple DER types might be used together
- Discussion of key factors in determining benefits and costs for each approach
- Guidance on how to address common challenges in determining benefits and costs in multi-DER use cases
- Case studies (for some of chapters)

Poll #6

Ch 11. Multi On-site DERs
Case Study: Commercial Grid-Interactive Efficient Building



Ch 11. Multi On-site DERs
Example of GEB Interactive Effects



Ch 12. Non-Wires Solutions

BCA Considerations and Challenges

Considerations

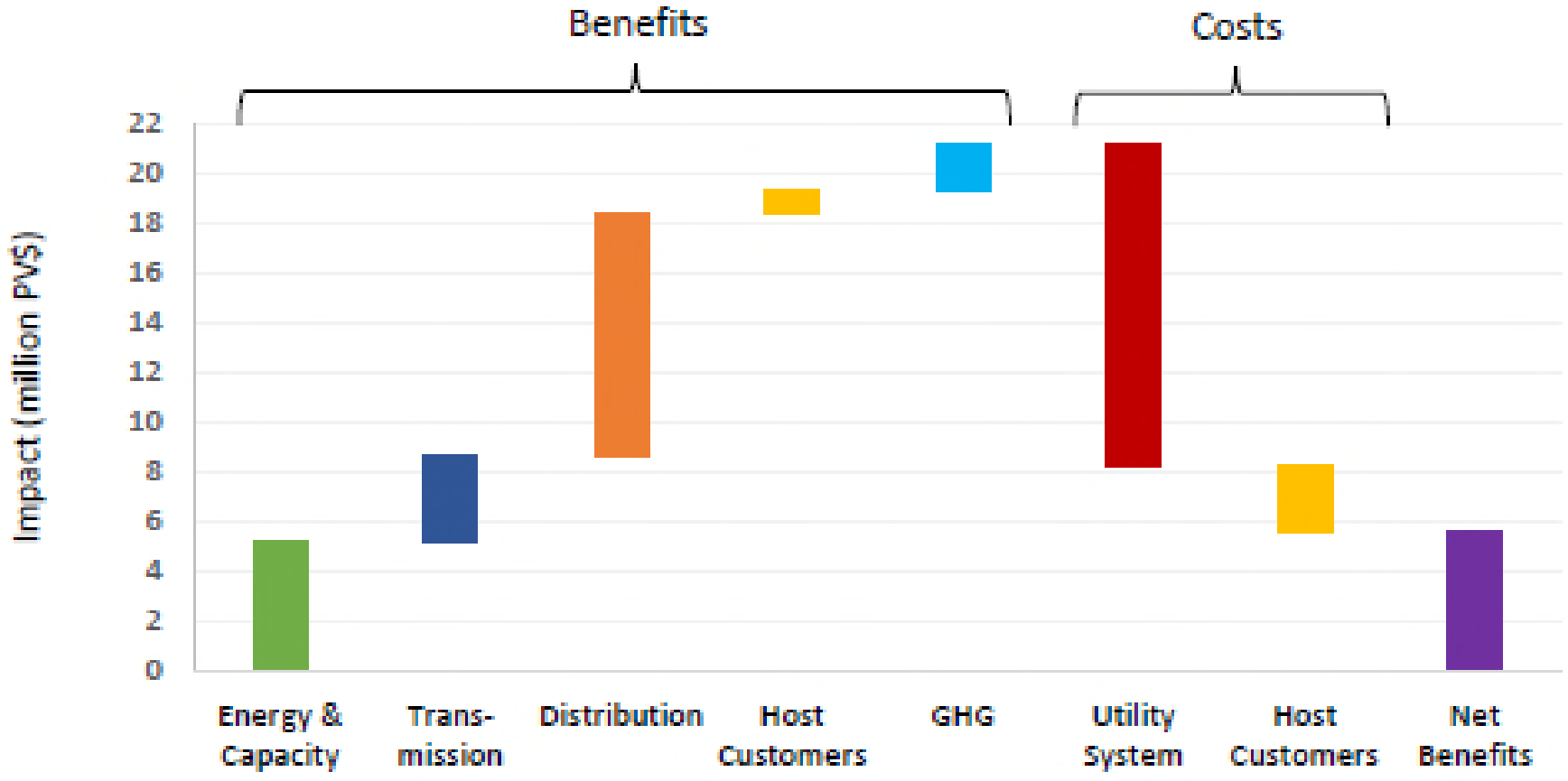
- Geo-targeting of DERs in high-value location
- Characteristics of traditional infrastructure project (type, timing, etc.)
- NWS technology characteristics
- Impacts beyond the targeted T&D deferral

Challenges

- Deriving granular locational and temporal values
- Accounting for option value
- Interactive effects between DERs
- Evaluating and measuring NWS impacts
- Accounting for system reliability and risk

Ch 12. Non-Wires Solutions

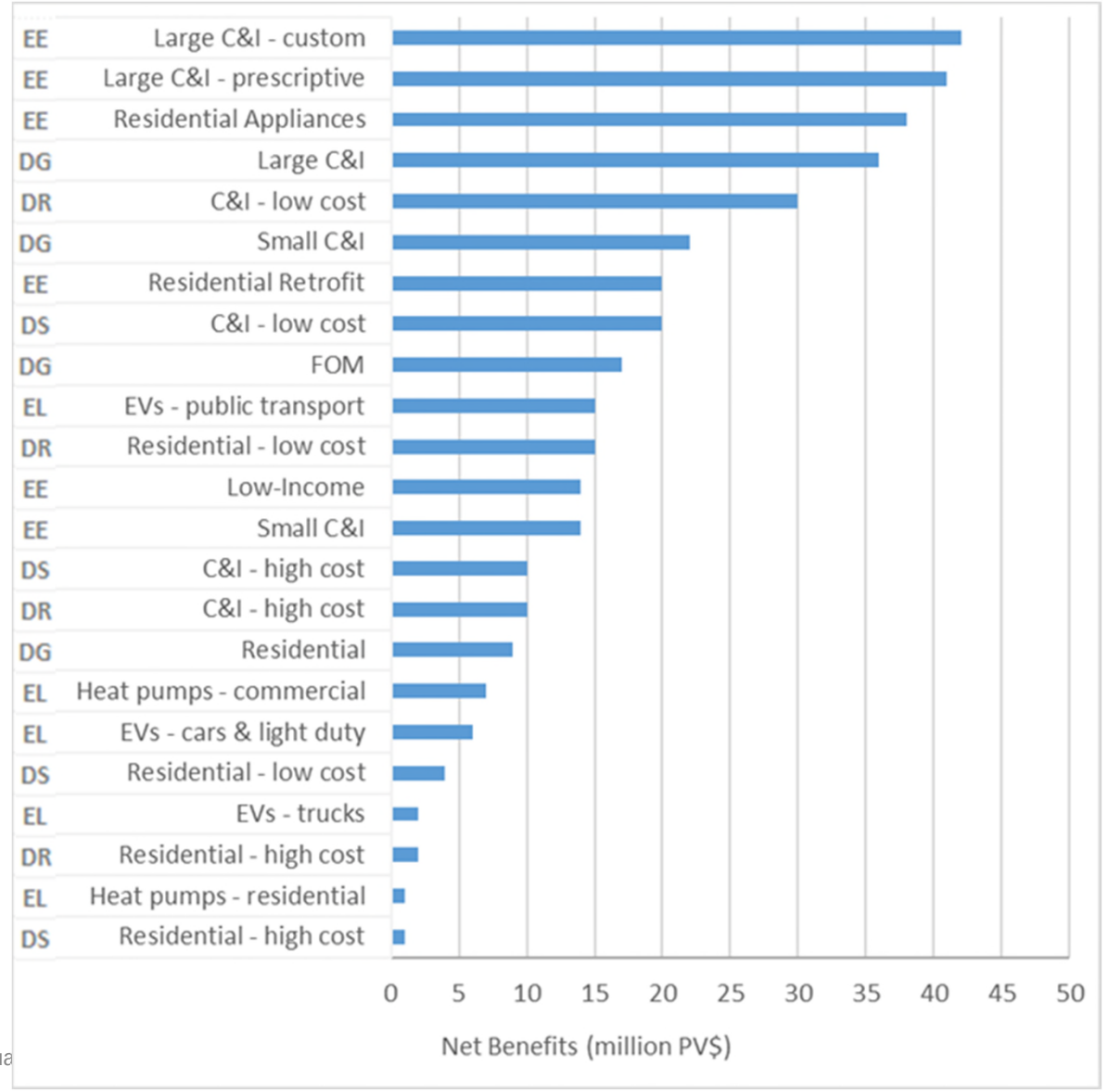
Case Study – NWS Distribution Need



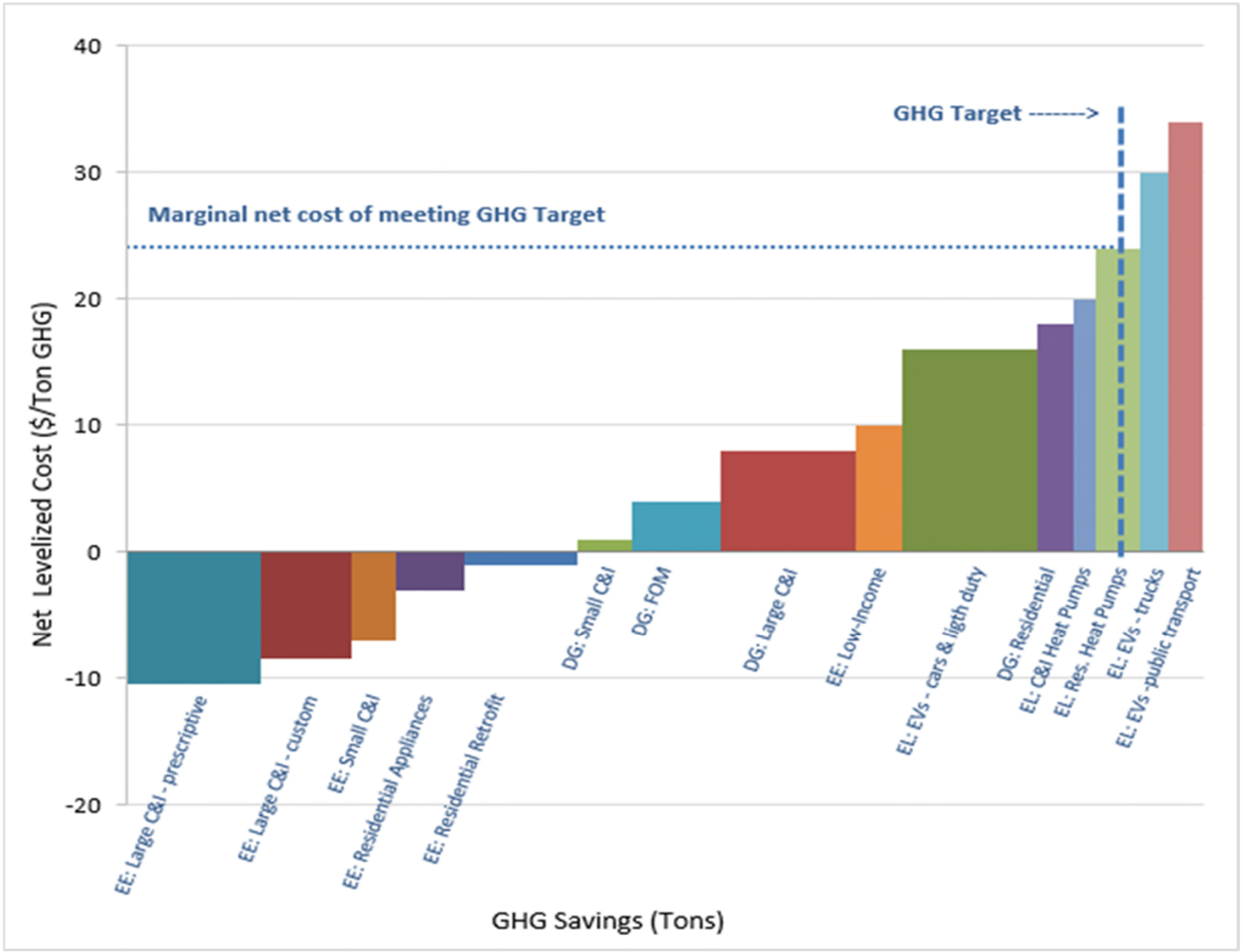
Ch. 13. System-Wide DER Portfolios

- Question: How should any one utility optimize all DER types?
  - What to do in the absence of IDP or IGP?
- Ideally, each jurisdiction should use a single primary BCA test for all DER types (EE, DR, DG, storage, electrification, EVs).
  - This may require reconciling different policy goals for different DER types.
- Then, the jurisdiction should identify planning objectives:
  - Implement the most cost-effective DERs.
  - Encourage a diverse range of DER technologies.
  - Encourage customer equity.
  - Achieve GHG goals at lowest cost.
  - Avoid unreasonable rate impacts.
  - Implement all cost-effective DERs.
  - Achieve multiple planning objectives.

Ch 13. Objective: Implement the Most Cost-Effective DERs

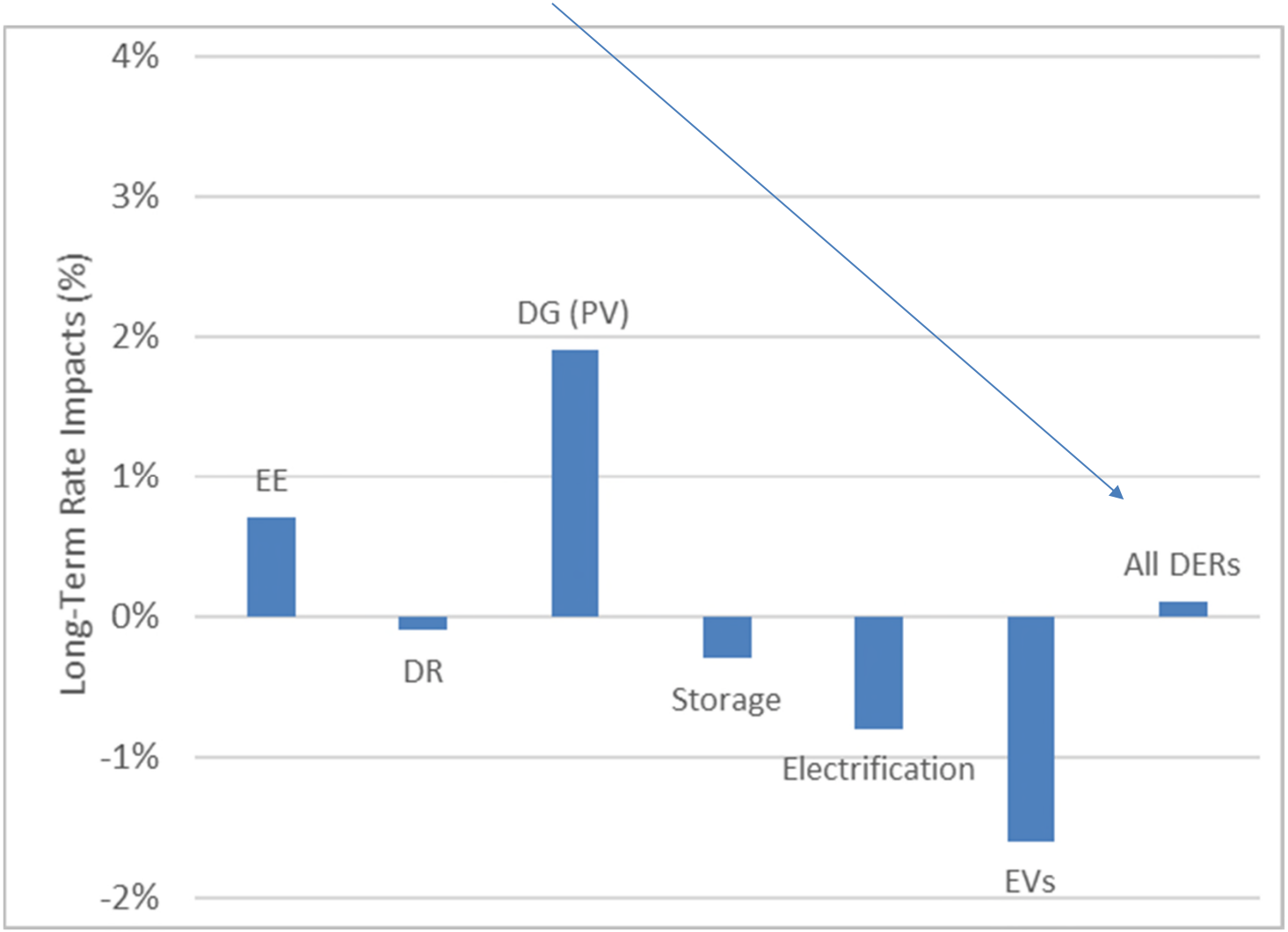


Ch 13. Objective: Achieve GHG Goals at Lowest Cost



Ch 13. Objective: Avoid unreasonable rate impacts

Rate impact analyses should account for combined effect of all DER types



Ch 14. Dynamic System Planning

Type of Utility System	Planning Practice	Planning Practice Accounts for:			
		Distribution System	DERs	Transmission System	Utility-Scale Generation
Distribution-only & vertically-integrated	Traditional distribution planning	✓	-	-	-
	Integrated distribution planning	✓	✓	-	-
Vertically-integrated	Transmission planning	-	-	✓	-
	Integrated resource planning	-	✓	-	✓
	Integrated grid planning	✓	✓	✓	✓

Poll #7

NSPM for DERs – Education and Training

- Webinars and Training (2020-21)
  - Webinars/presentations – see upcoming events at: https://www.nationalenergyscreeningproject.org/national-standard-practice-manual/presentations-events/
  - National Regulatory Research Institute (NRRI) and Regulatory Training Initiative (RTI) – discussions in process to develop a BCA on-line training for the NSPM
- State specific education and technical support
  - TBD - contingent upon funding

NSPM is a 'living document' and will be updated and improved over time, adding case studies, addressing gaps, etc. contingent upon funding

Poll #8

Thank you!

For More Info…

To download the NSPM and find supporting Resources visit:
http://www.nationalenergyscreeningproject.org/

Stay informed with the *NSPM Quarterly* Newsletter:

https://nationalenergyscreeningproject.org/national-standard-practice-manual/news/

Questions? Email NSPM@nationalenergyscreeningproject.org